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Published in:
Meeting Abstracts - Electrochemical Society

Publication date:
2010

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
Bræstrup, F. R., & Kammer Hansen, K. (2010). Electrochemical Reduction of NO_x Gases on Spinel-Type Electrode Materials. In *Meeting Abstracts - Electrochemical Society* The Electrochemical Society.

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Electrochemical reduction of NO_x gases on spinel-type
electrode materials

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Three-way automotive catalysts are effective systems for cleaning exhaust gases from gasoline engines, when used with a specified air/fuel ratio. However, this system cannot reduce nitrogen oxides (NO_x) in exhaust streams containing several percent of oxygen, namely, under lean-burn conditions. The emission of NO_x from diesel and lean-burn engines causes serious environmental damage due to acid rain and air pollution especially in urban areas. Several attempts have been made to remove NO_x from the exhaust gases but so far no method has been developed without the use of reducing agents which has to be incorporated in the vehicle.

Different spinel-type oxides (MgFe₂O₄, ZnFe₂O₄ and NiMn₂O₄, NiCr₂O₄) have been analyzed as possible candidates for electrochemically to reduce of NO_x gases. Cells of different geometries were characterized with impedance spectroscopy and cyclic voltammetry from 300 °C – 600 °C in 10 % O₂, 1 % NO, 1% NO₂ and gas mixtures of NO and O₂. Many of them show a high activity and apparent selectivity towards NO reduction. A small conversion of NO_x gases in an oxygen containing atmosphere could be detected over the MgFe₂O₄ and the ZnFe₂O₄ electrodes, however, the conductivity of the spinels is relative low and the compounds seem therefore more useful as infiltration materials in a suitable back bone structure.